STMicroelectronics NUCLEO-F446RE-STMICROELECTRONICS_IT

STM32 Nucleo Development Board with STM32F446RE MCU NUCLEO-F446RE User Manual

Model: NUCLEO-F446RE-STMICROELECTRONICS_IT | Brand: STMicroelectronics

Introduction

This manual provides comprehensive instructions for the setup, operation, maintenance, and troubleshooting of the STM32 Nucleo Development Board with STM32F446RE MCU. Please read this manual thoroughly before using the product to ensure proper functionality and safety.

Figure 1: Front view of the STM32 Nucleo Development Board.

The STM32 Nucleo Development Board is a versatile platform designed to help users explore and develop solutions with the STM32 microcontroller. It features an STM32F446RE MCU, offering high performance with an ARM Cortex-M4 core, DSP, and FPU capabilities.

Setup Guide

Follow these steps to set up your STM32 Nucleo Development Board:

1. **Check Jumper Positions:** Ensure the following jumper settings are configured correctly:
    - JP1: Off

- JP5 (PWR): On U5V side
- JP6 (IDD): On

2. **Connect to PC:** Connect the STM32 Nucleo board to your PC using a USB Type-A to Mini-B cable. Use the USB connector labeled CN1 on the board to supply power.
3. **Verify Power and Communication LEDs:** Upon successful connection, the red LEDs LD3 (PWR) and LD1 (COM) should light up. The green LED LD2 should blink, indicating communication activity.
4. **Test User Button:** Press the user button B1 (located on the left side of the board). Observe how the blinking pattern of the green LED LD2 changes with each press, confirming basic board functionality.

Figure 2: Rear view of the product packaging, showing initial setup instructions.

This image illustrates the "Getting Started" section found on the product packaging, detailing the initial steps for connecting and powering the board, as well as verifying its basic operation through LED indicators and the user button.

Operating Instructions

The STM32 Nucleo board is designed for flexible development. Here's how to begin operating and developing with it:

System Requirements

To ensure compatibility and proper functioning of the development environment, your computer should meet the following minimum requirements:

- **Operating System:** Windows® OS (7, 8, or 10), Linux® 64-bit, or macOS®.
- **Connectivity:** A USB Type-A to Mini-B cable is required for connection to the board.

Development Toolchains

The board supports a wide range of Integrated Development Environments (IDEs) and toolchains, allowing developers to choose their preferred environment:

- Keil® MDK-ARM®
- IAR™ EWARM®
- GCC-based IDEs
- Arm® Mbed™ online (Note: This option is supported on Windows® only)

Embedded Software and Examples

STMicroelectronics provides comprehensive software support for the STM32 Nucleo board:

- **STM32CubeF4 MCU Package:** This package features essential drivers, a Real-Time Operating System (RTOS), file system support, USB functionalities, TCP/IP stacks, graphics libraries, and numerous examples specifically tailored for this board.
- **Demo Software:** Several demo software applications and examples are available to help users explore the full range of STM32 Nucleo features. These can typically be found on the official STMicroelectronics website: www.st.com/stm32nucleo.
- **Application Development:** Users are encouraged to develop their own applications using the provided examples as a starting point.

Key Features for Operation

- **Microcontroller:** STM32F446RE MCU with ARM Cortex-M4 core, DSP, and FPU.
- **Memory:** 512 Kbytes Flash memory.
- **Clock Speed:** 180 MHz CPU.
- **Accelerators:** ART Accelerator, Dual QSPI.
- **Debugger/Programmer:** On-board ST-LINK/V2-1 debugger/programmer with SWD connector for easy debugging and firmware flashing.
- **Power Supply:** Can be powered directly from USB.
- **User Interface:** Includes three LEDs (Power, Communication, User) and two push-buttons (Reset, User) for basic interaction and debugging.

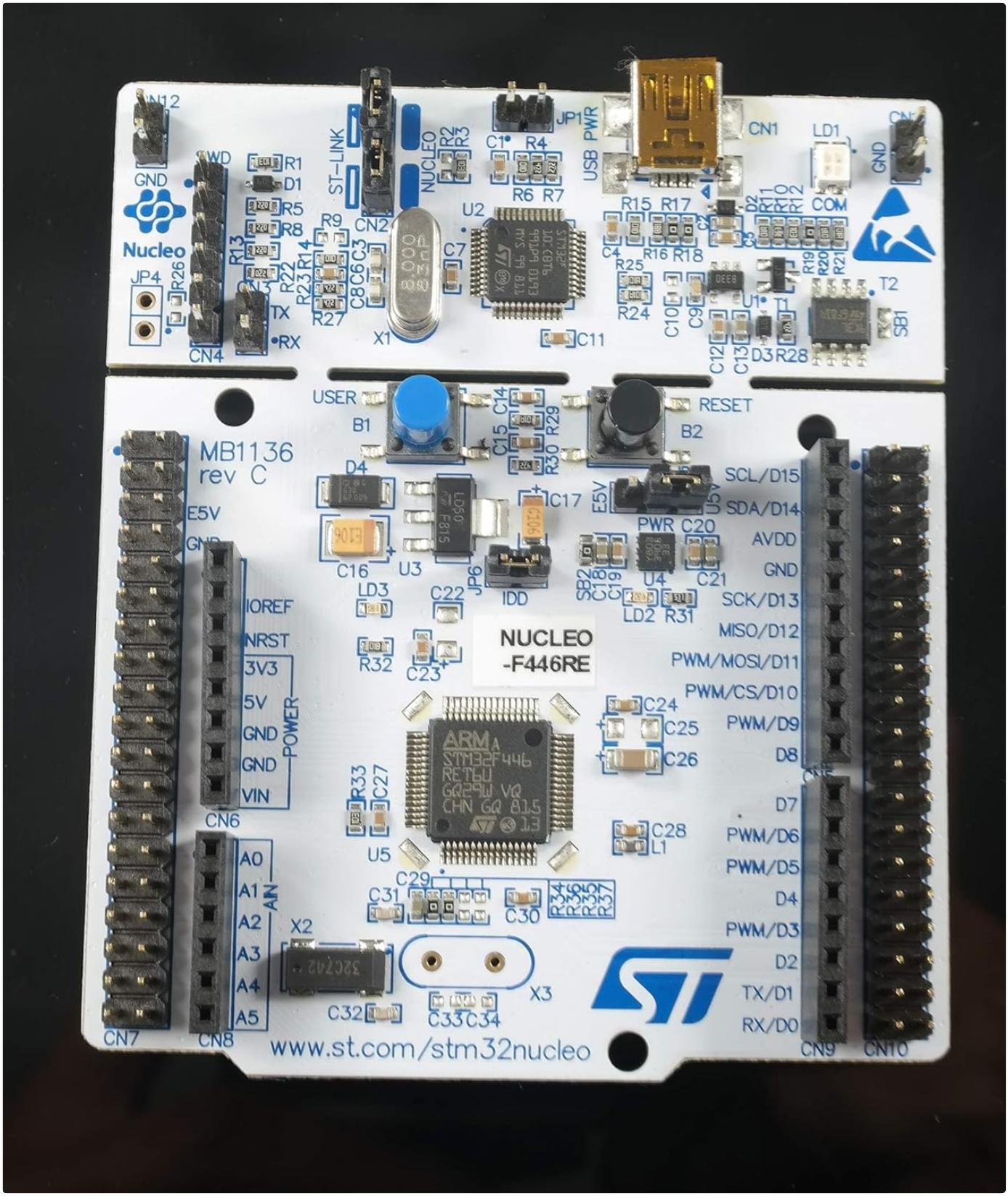

Figure 3: Detailed top view of the STM32 Nucleo Development Board.

This image provides a clear view of the components on the top side of the Nucleo board, including the STM32F446RE microcontroller, various headers, LEDs, and buttons, which are crucial for understanding its operation.

Maintenance

To ensure the longevity and optimal performance of your STM32 Nucleo Development Board, follow these maintenance guidelines:

- **Handling:** Always handle the board by its edges to avoid touching sensitive components, which can be damaged by static electricity or oils from your skin.

- **Storage:** Store the board in an anti-static bag when not in use, especially in environments prone to static discharge. Keep it in a dry, cool place away from direct sunlight and extreme temperatures.
- **Cleaning:** If necessary, gently clean the board with a soft, dry, anti-static brush or a lint-free cloth. Avoid using liquids or abrasive cleaners. For stubborn dust, a can of compressed air can be used, holding it upright to prevent propellant discharge.
- **Power Off:** Always disconnect power from the board before making any physical connections or disconnections (e.g., adding shields, changing jumpers).
- **Environmental Conditions:** Operate the board within its specified environmental conditions (temperature, humidity) to prevent damage.

Troubleshooting

This section provides solutions to common issues you might encounter with your STM32 Nucleo Development Board.

Common Issues and Solutions

Problem	Possible Cause	Solution
Board does not power on (LD3 PWR LED off).	No power supply; incorrect USB connection; faulty USB cable.	• Ensure USB cable is securely connected to both the board (CN1) and the PC. • Try a different USB port on your PC. • Test with a different USB Type-A to Mini-B cable. • Verify PC's USB port is providing sufficient power.
LD1 COM LED is off or not blinking.	ST-LINK driver not installed; communication error; incorrect jumper settings.	• Install the latest ST-LINK drivers from the STMicroelectronics website. • Check Device Manager (Windows) or equivalent for driver issues. • Verify JP1, JP5, and JP6 jumper settings as per the Setup Guide. • Restart your PC and reconnect the board.
Cannot upload firmware or debug.	Incorrect IDE configuration; driver issues; board in wrong mode.	• Ensure your IDE (Keil, IAR, GCC-based) is correctly configured for the STM32F446RE and ST-LINK/V2-1. • Verify ST-LINK drivers are properly installed and recognized. • Check that the board is not in a low-power or reset state. • Consult your IDE's documentation for specific debugging setup.
User button B1 does not respond.	Software issue; button malfunction.	• Ensure the demo software or your application code correctly reads the button input. • Verify the LD2 LED blinks when the button is pressed, indicating hardware response. If not, there might be a hardware issue.

If you encounter issues not listed here, refer to the official STMicroelectronics documentation and community forums for further assistance.

Specifications

Detailed technical specifications for the STM32 Nucleo Development Board with STM32F446RE MCU:

Feature	Detail
Model Number	NUCLEO-F446RE-STMICROELECTRONICS_IT
ASIN	B01I8XLEM8
Manufacturer	STMicroelectronics
Microcontroller	STM32F446RE (ARM Cortex-M4 core with DSP and FPU)
Flash Memory	512 Kbytes
CPU Speed	180 MHz
Accelerators	ART Accelerator, Dual QSPI
Debugger/Programmer	On-board ST-LINK/V2-1 with SWD connector
Power Supply	USB powered
User Interface	3 LEDs (PWR, COM, User), 2 Push-buttons (Reset, User)
Product Dimensions	4 x 3 x 1 inches
Item Weight	2.4 ounces
Date First Available	October 29, 2016

Figure 4: Detailed bottom view of the STM32 Nucleo Development Board.

This image displays the underside of the Nucleo board, revealing additional components, solder points, and markings that contribute to its overall functionality and design.

Warranty and Support

STMicroelectronics products are designed and manufactured to high-quality standards. For specific warranty information, please refer to the documentation provided with your purchase or visit the official STMicroelectronics website.
For technical support, resources, and community forums, please visit the official STMicroelectronics support page. You can find extensive documentation, software downloads, and answers to frequently asked questions related to the STM32 Nucleo Development Boards.

Official Website: www.st.com/stm32nucleo
Support Resources: www.st.com/support